**#3**

*IoT and Smart Cities*

**How are cities progressing with the adoption of AI**

*Difficulty Level: Basic*

*Completion Period: 2 hours*

**Objectives:**

1. Understand the concept of smart cities and their objectives: Students should be able to define what constitutes a smart city, identify the key objectives of implementing AI in cities, and explain how AI contributes to the overall progress and development of urban environments.
2. Explore the applications of AI in smart cities: Students should gain knowledge about various AI applications in smart cities, such as intelligent transportation systems, energy management, public safety, waste management, and citizen services. They should be able to explain how AI is transforming these domains and improving efficiency and sustainability.
3. Evaluate the impact of AI on city infrastructure and services: Students should assess the implications of AI adoption on urban infrastructure, governance, and service delivery. They should analyse the benefits and potential drawbacks of using AI systems in areas such as transportation, healthcare, public safety, and resource management.

By addressing these learning objectives, VET students can gain a comprehensive understanding of how cities are progressing with the adoption of AI, the associated benefits and challenges, and the strategies required for responsible and sustainable implementation.

**How Artificial Intelligence Works, And How We Have Reached The Point Where Its Rollout In Cities And Public Spaces Is The Next Step In Smart City Evolution?**

Charbel Aoun[[1]](#endnote-1), Smart City and Space Director, EMEA, NVIDIA, provides an update on where cities have got to in their AI journeys, what’s informing their progress, and which applications are maturing quickest.

In the context of understanding how AI works, there are two important aspects to consider: training and inferencing. When it comes to training, it’s comparable to teaching a child. We train AI systems to recognise things just like humans do. By showing them imagery repeatedly, we enable them to learn and understand different concepts. For example, if we want to analyse traffic patterns or use space efficiently through mobility, its a case of repeatedly exposing the AI to images of buses, taxis, bikes, and so on, in various conditions like day and night, rain and fog. Through this iterative process, the AI gradually develops the ability to accurately identify objects, achieving a certain percentage of accuracy.



*AI deployment is much more than picking a solution, says Aoun*

Once the AI model reaches a mature stage, it is packaged and deployed for inferencing. Inferencing is the second part of the AI’s job, where it applies what it has learned to make educated guesses. As real-time data flows in, the AI converts visual information into text or other forms of non-imagery data. This data, along with additional metadata like timestamps and environmental factors, is processed using logic and business rules.

For efficient inferencing, high-powered computing is necessary, especially when dealing with complex models or high volumes of data. Traditional computing methods may not suffice due to the time it takes to process the data. This is where accelerated compute and parallel processing come into play. Such advanced computing capabilities allow multiple AI models to run simultaneously. For instance, a camera can be equipped with multiple models to detect not only vehicles but also fires, smoke, fights, accidents, and more. This multi-modal deployment provides multiple conclusions from a single data source, requiring substantial processing power.

The deployment options include the edge, where a high-capacity AI system is placed directly within or near the sensor, or a data centre where multiple cameras are connected to a central point like a server. These setups can be found in locations like stadiums or airports. Alternatively, cloud deployment can be chosen when time-critical processing is not a requirement, and data can be transmitted to a remote cloud server for analysis.

When it comes to digital transformation in cities, we have seen various terms emerge to describe this shift including smart city, intelligent city, cognitive city, and green city. Initially, the focus was on using information technology to improve efficiency and reduce waste in urban environments facing infrastructure challenges due to factors like urbanisation and migration. The traditional approach of expanding infrastructure proved inadequate, leading to the need for smarter solutions that optimise limited space and capacity.

The evolution of technology played a crucial role in this transformation. As connectivity became more pervasive, the initial emphasis was on connecting devices, resulting in IP-enabled solutions. This paved the way for querying devices bidirectionally, leading to the birth of IoT, smart devices, and a surge in data known as "datafication". With the huge growth of connected IoT devices, along with advancements in mobile computing, cloud technology, and faster connectivity like 4G and 5G, a vast amount of data became available, creating a new challenge in how to use it effectively.

Debates emerged around concepts like big data, and useful data versus wasteful data. Finding ways to extract value from this massive amount of data became a pressing issue in the quest for digital transformation. The conclusion reached was that relying solely on data scientists to process and analyse data through traditional methods, like business intelligence platforms and query languages such as SQL, was not scalable. The emergence of edge computing changed this scenario by significantly reducing the cost of computation, however. Technologies like GPUs introduced parallel computing and accelerated computing, delivering performance improvements of 100x to 1,000x.

"The convergence of technologies like 5G, deep learning, and GPT AI has ushered in a revolution where AI is now poised to power the next 30, 40, 50, or even 60 years of innovation, just as the internet powered the previous three decades"

This reduction in costs and increase in computational capacity led to deep learning, where machines could be taught to process data regardless of its size. The machine would learn how to handle and analyse the data, eliminating the need for an extensive workforce and instead requiring ample computational power. The larger the dataset, the faster the processing speed, and the more remarkable the results. We entered an era where we could genuinely accomplish the seemingly impossible.

The convergence of technologies like 5G, deep learning, and GPT AI has ushered in a revolution where AI is now poised to power the next 30, 40, 50, or even 60 years of innovation, just as the internet powered the previous three decades. AI can now be integrated into various applications, including autonomous vehicles and sensors. This integration requires the collaboration of different components and stakeholders to create a seamless and frictionless experience.

Cities have begun embracing this technological shift, recognising the potential of AI to address problems and create value for their citizens. The focus has shifted from understanding AI as a concept to exploring its practical applications and impact. Deploying AI in areas like traffic management can significantly reduce accidents, sometimes by as much as 70 per cent depending on traffic flow and location, while factories can leverage AI to optimise machine performance, enhance safety, and predict maintenance requirements. Furthermore, AI-assisted autonomous vehicles can enhance safety by proactively responding to potential risks.

The potential applications extend to analysing how people use roads and spaces, combining visual sensors with air quality monitoring, and integrating data with healthcare and emergency systems. This enables informed decision-making, such as dynamically changing traffic light patterns based on air quality and traffic conditions. However, integration into practical city operations involves more than just technological capabilities. It requires putting processes in place and managing change to ensure comfort and acceptance among city operators and decision-makers.

Cities are at various stages of adoption, with traffic, transport, airports, rail stations, and highways being notable areas of focus. Airports can optimise operations, enhance health and safety measures, and manage risks by understanding people’s behaviour. Train stations can monitor crowds, analyse barrier usage, inspect tracks, and ensure health and safety through anonymous analytics. The list of potential applications and use cases is extensive and continues to grow.

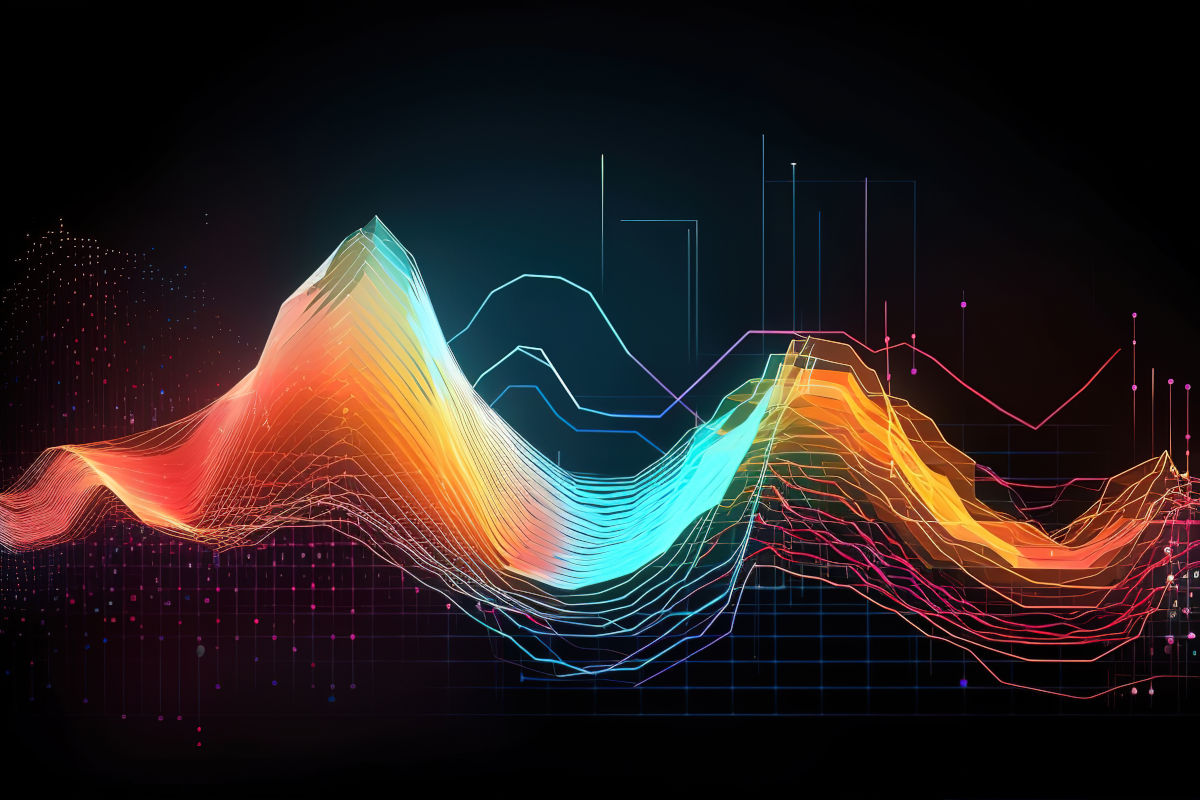
**Have You Found It Easier To Engage With One Sector Over Another On AI? Is One Over The Other More Actively Seeking AI-Enabled Solutions?**

In terms of engaging with different sectors on AI, the ease of engagement varies depending on the region. Specifically, in the regions I cover – such as Europe, Middle East, and Africa – certain countries like the UK, Germany, France, Italy, and Spain are actively seeking AI-enabled solutions. Middle Eastern cities, in particular, approach NVIDIA with specific goals and ask for assistance in achieving them, but this level of engagement is limited to a smaller percentage of cities.

"The majority of cities, representing around 70 per cent, are still in the process of learning about AI, and may lack the necessary infrastructure and understanding of how to embark on their AI journey"

If we consider the maturity curve of technological savviness or digital transformation in cities, the more advanced cities are proactive in seeking out AI solutions. They have already done their research, read about successful cases, and are eager to explore further. These cities actively invite us to show them what we can offer and introduce them to the possibilities. However, the majority of cities, representing around 70 per cent, are still in the process of learning about AI, and may lack the necessary infrastructure and understanding of how to embark on their AI journey.

Starting the AI journey goes beyond simply buying a box or a solution. Many cities express the desire to use their own data and develop their own models. Some cities have dedicated entities within them, such as IT or AI-driven teams, who are already mature in their understanding and implementation of AI. These cities recognise the value of working with a company like NVIDIA, as we provide them with tools and accelerate their AI initiatives.



*Cities are at very differing stages of their AI journey,*

*with as many as 70 per cent of cities still learning about the possibilities*

In contrast, there are two other types of cities. The first type understands AI but lacks the resources and expertise to implement it. They seek ready-made, off-the-shelf solutions, and that’s where the ecosystem we’ve created becomes beneficial. The second type of city requires both a better understanding of AI and the necessary resources to implement it. These cities take a more modest and cautious approach, exploring AI solutions at a slower pace. Overall, I think a significant portion of cities fall into the category of needing further education and lacking resources to fully embrace AI.

**In Terms Of Local Authority Interest In AI Solutions, Are You Seeing It Driven More By The Tier One Cities Who Have More Resources?**

In the past, it was generally true that tier one cities with more resources were the primary drivers of city government and local authority interest in AI solutions. However, the landscape has shifted, and now the driving force behind AI adoption extends beyond the size or resources of a city; it’s now about talent and leadership.

There’s a small town in Germany with a population of around 9,000 people. This town possesses individuals with exceptional intelligence and visionary leadership who understand the value of AI, and so they are leveraging computer vision technology to scan the entire town and create a digital twin. Sometimes, smaller cities can be more agile and manageable, making it easier to implement AI solutions compared to larger and more complex cities.

"It is no longer a matter of big cities alone driving interest in AI solutions. Both large and small cities are actively exploring AI’s potential, driven by talent, visionary leadership, and initiatives that foster innovation and collaboration."

The deployment of AI in cities really comes down to a combination of factors. The availability of talent and leadership that recognises the potential of the technology plays a significant role. However, when we talk about “talent”, it’s important to remember this extends beyond individuals. We are now witnessing cities becoming pioneers by investing in AI platforms and opening up opportunities for innovation and collaboration with universities and research institutions. The main barriers for startups and job creation in the AI field are infrastructure and access to data. Forward-thinking cities are addressing this by investing in compute infrastructure, whether through public-private partnerships or other models. The focus is not on who owns the platform, but rather the existence of a platform itself. By providing compute resources, making relevant data available, and fostering connections with universities and local communities, these cities are generating numerous local initiatives and upskilling their workforce, preparing them with the skills of the future. This, in turn, leads to job creation as startups emerge from these endeavours.

It is no longer a matter of big cities alone driving interest in AI solutions. Both large and small cities are actively exploring AI’s potential, driven by talent, visionary leadership, and initiatives that foster innovation and collaboration.

**Quiz on AI infrastructure in smarts cities**

1. **What is the primary purpose of AI infrastructure in smart cities?**

a) Enhancing entertainment options

b) Improving transportation systems

c) Increasing social media usage

d) Promoting online shopping

1. **True or False: AI infrastructure in smart cities primarily focuses on collecting and analyzing data.**

a) True

b) False

1. **Which of the following is an example of AI infrastructure in smart cities?**

a) Automated street lighting

b) Virtual reality gaming centers

c) Social media platforms

d) Online shopping websites

1. **What role does data play in AI infrastructure in smart cities?**

a) Data is used to train AI algorithms.

b) Data is irrelevant in AI infrastructure.

c) AI infrastructure doesn't rely on data.

d) Data is used for advertising purposes only.

1. **What is the purpose of sensors in AI infrastructure in smart cities?**

a) To monitor environmental conditions

b) To provide high-speed internet connectivity

c) To control traffic lights

d) To stream movies and TV shows

1. **True or False: Privacy and security concerns are important considerations in AI infrastructure development in smart cities.**

a) True

b) False

1. **Which of the following technologies are commonly integrated into AI infrastructure in smart cities?**

a) Internet of Things (IoT)

b) Blockchain

c) Augmented Reality (AR)

d) All of the above

1. **How can AI infrastructure contribute to energy efficiency in smart cities?**

a) Optimizing energy usage

b) Increasing energy consumption

c) Reducing renewable energy sources

d) Ignoring energy conservation measures

1. **What is the purpose of AI-powered smart grids in smart cities?**

a) Monitoring and controlling energy distribution

b) Promoting excessive energy consumption

c) Disrupting energy supply to households

d) Encouraging energy waste

1. **How does AI infrastructure improve the quality of life in smart cities?**

a) Enhancing public safety

b) Improving healthcare services

c) Optimizing waste management

d) All of the above

Answers:

1. b) Improving transportation systems
2. a) True
3. a) Automated street lighting
4. a) Data is used to train AI algorithms.
5. a) To monitor environmental conditions
6. a) True
7. d) All of the above
8. a) Optimizing energy usage
9. a) Monitoring and controlling energy distribution
10. d) All of the above

**More reading:**

* City data spaces: A guide to building and operationalising data services

*(has to be uploaded on project website – in ettc file)*

1. [Smart Cities World - AI and Machine Learning - How are cities progressing with the adoption of AI?](https://www.smartcitiesworld.net/ai-and-machine-learning/ai-and-machine-learning/how-are-cities-progressing-with-the-adoption-of-ai?utm_source=newsletter&utm_medium=email&utm_campaign=Weekly%20Newsletter) [↑](#endnote-ref-1)